

## EPA Superfund Sites in South Dakota

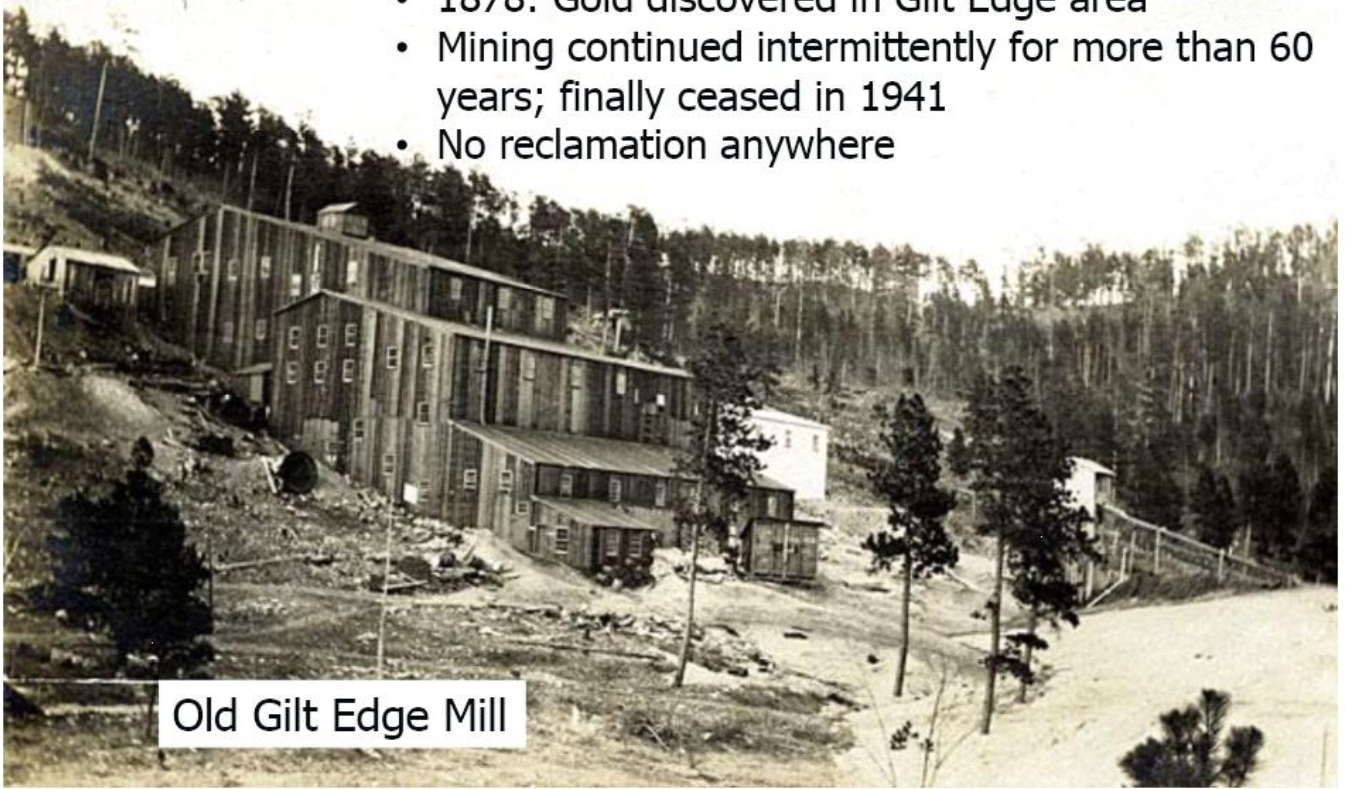
1. Whitewood Creek – Listed 1983
2. Williams Pipe Line – Listed 1990
3. Ellsworth Air Force Base – Listed 1990
4. Brohm Gold Mine – Listed 2000

# EPA Gilt Edge Mine Superfund Site



# Early Mine History

- 1878: Gold discovered in Gilt Edge area
- Mining continued intermittently for more than 60 years; finally ceased in 1941
- No reclamation anywhere



Old Gilt Edge Mill



## In the early 1980's before Brohm

- **Barren tailing piles left from historic mining prior to Brohm**
- **Between old mine pits and eroding tailings piles, the whole area looked like a warzone**



## In the early 1980's before Brohm

- **Strawberry Creek was full of sediment from eroding tailing piles**
- **Puke orange in color, low pH, high metals, void of all aquatic life**





## Brohm Mine History

- In 1986, Brohm acquired the 258 acre site, permit, and \$1.2 million reclamation bond
- Construction of a heap leach mine began in 1987 with many of the old tailings used as foundation material under lined areas
- Open pit, heap leach mine process – blast and haul ore from open pits, crush gold ore and place on lined heap leach pads, spray heaps with a cyanide solution to leach gold from ore, collect solution and recover gold

# Gilt Edge Superfund Site

## Site Features





## Brohm Mine History

- Mining began in 1988; mined out in 1992
- 1993 – things started to go bad; low gold prices put Brohm's parent company in financial trouble; Ruby Waste Rock Dump went acid
- Acid mine drainage – when buffering capacity in the rock provided by base minerals, such as limestone, are used up, naturally occurring sulfide minerals in the rock, such as pyrite, react with air and water to form sulfuric acid
- Sulfuric acid is bad , but also puts heavy metals into solution



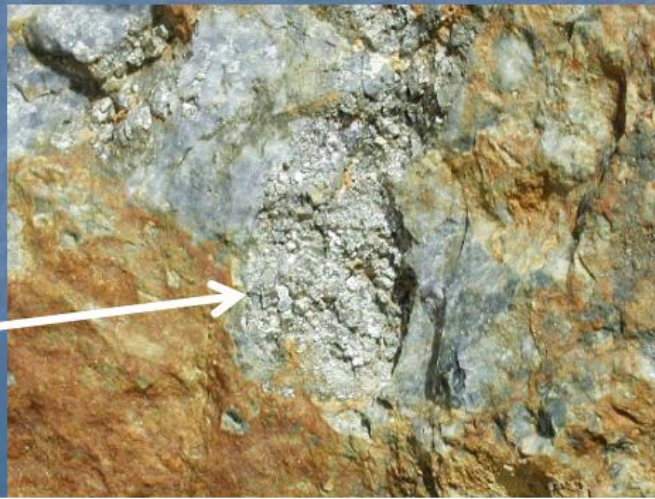
# Acid Mine Drainage Problem

## Generation of Acid Mine Drainage: Pyrite Oxidation



Pyrite ( $\text{FeS}_2$ ) is Iron Sulfide and also known as Fool's Gold

Gilt Edge Mine:  
Pyrite



# Gilt Edge Superfund Site

## Surface Flow from Mine to Sturgis Water Supply





## Brohm Mine History

- DENR required Brohm to collect and treat acid mine drainage – to pay for water treatment and increased reclamation costs, Brohm developed plan to mine Anchor Hill
- Board of Minerals approved Anchor Hill with conditions to build up the reclamation bond by getting a percentage of gross gold sales
- Mining Anchor Hill began in 1996; Brohm used cash flow to pay for water treatment and build reclamation bond up to \$6 million

## Brohm Mine History

- Anchor Hill highwalls hit Forest Service land which shut down mining in 1997
- Forest Service completed Environmental Impact Statement (EIS) to approve highwalls on 37 acres, environmental groups appealed; Forest Service withdrew EIS
- Brohm notified DENR it intended to abandon site in May, 1998; DENR went to court to obtain injunction preventing abandonment
- Environmental groups filed citizen's suit under Clean Water Act against Brohm



## Brohm Mine History

- Brohm convinced an existing creditor to extend temporary financing while it continued to seek Forest Service approval, but credit was cut off and bankruptcy filed in July 1999
- DENR made Brohm pay its bills until there was no money left; Brohm left us with 150 million gallons of acidic heavy metal-laden water stored in three pits
- With the treatment plant shut down, the pits were filling up with acidic water

## Brohm Mine History

- To keep the site environmentally safe, Governor Janklow authorized DENR to take over the site by using its Regulated Substance Response Fund to hire some of the Brohm staff to start up and operate the water treatment plant to regain a safe water balance on site
- DENR operated the site without a spill or release for 396 days



## Gilt Edge Superfund Site

- EPA took over with its Superfund emergency response program in August 2000.
- The site was listed on the EPA National Priority List on December 1, 2000; EPA named it the Gilt Edge Superfund Site
- Superfund is not a free lunch; the state must pay 10% of the cleanup costs
- After cleanup, state costs go up - under the Superfund law, the state must pay 100% of the water treatment plus site operation and maintenance costs after EPA leaves

# Gilt Edge Superfund Costs

## Superfund Expenditures between 7/1/99 to 6/30/15 Requiring 10% State Match

<u>Reclamation Components</u>	<u>EPA Superfund Costs</u>	<u>10% State Match</u>
Site Operation & Maintenance	\$34,685,956	\$3,468,596
Water Treatment Plant Conversion	\$3,085,758	\$308,576
<u>Ruby Dump Grading &amp; Capping</u>	<u>\$23,481,219</u>	<u>\$2,348,122</u>
Total	\$61,252,933	\$6,125,294

<u>Sources of 10% State Match</u>	<u>Amounts Spent</u>	<u>Amounts Remaining</u>
Regulated Substance Response Fund	\$2,866,322	\$2,573,000
Brohm Bond	\$2,000,000	\$7,988,200
In-kind Soft Match	\$1,258,972	annual budget
<u>EPA Responsible Party Settlements</u>	<u>\$0</u>	<u>\$8,567,949</u>
Total	\$6,125,294	\$19,129,149



# Gilt Edge Superfund Costs

**As EPA continues cleanup, the state will have to continue to provide a 10% match**

<b><u>Reclamation Components</u></b>	<b><u>Estimated EPA Costs</u></b>	<b><u>10% State Match</u></b>
Site-Wide Earth Work	\$89,500,263	\$8,950,026
Site Operation & Maintenance	\$20,000,000	\$2,000,000
Water Treatment Plant Upgrade	\$5,000,000	\$500,000
Totals	\$114,500,263	\$11,450,026

**The Superfund law makes the state responsible for 100% of the costs after EPA completes the cleanup and leaves.**

The acid mine drainage will need to be collected and treated into perpetuity.

Water treatment costs EPA about \$2,000,000 per year.

The state water treatment costs will depend on how effective the caps are at cutting off air and water to reduce the volume of acid mine drainage.

<b><u>Long Term Costs</u></b>	<b><u>EPA Costs</u></b>	<b><u>100% State Cost</u></b>
Water Treatment Costs	\$0	Will depend on cap
Cap Maintenance and Repair	\$0	effectiveness at reducing acid drainage

# Gilt Edge Mine Tour Route





# Gilt Edge Superfund Site

## Anchor Hill Pit



**Pit Capacity: 161 million gallons; current storage is 27 million gallons**

# Gilt Edge Superfund Site

## Dakota Maid Pit



**Pit Capacity: 15 million gallons; current storage is 6.2 million gallons**



# Gilt Edge Superfund Site

## Sunday Pit



**Pit Capacity: 60 million gallons; current storage is 41 million gallons**

# Gilt Edge Superfund Site

## Water Treatment Plant





# Water Treatment Plant



# Gilt Edge Superfund Site

## Ruby Waste Rock Repository

- Largest single source of acid
- 65 acres
- 300 feet deep
- 17 million tons of rock





# Gilt Edge Superfund Site

## Cleanup Progress since 2000:

- Replaced the old caustic water treatment plant with a new lime based plant
- Removed some old buildings
- Installed clean water diversions/ditches on both sides of Ruby Waste Rock Dump to reduce amount of water getting into dump
- Lined and capped Ruby Dump to reduce amount of air and water getting into dump

# Gilt Edge Superfund Site

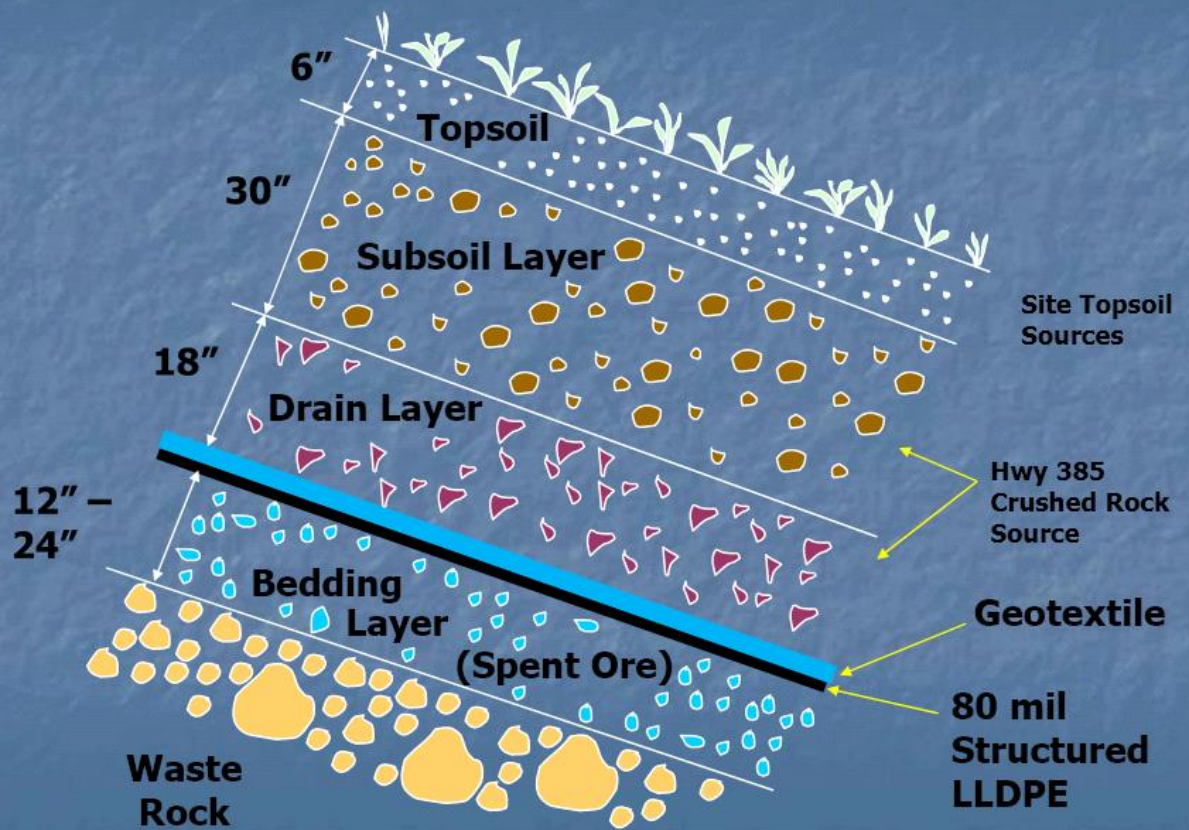
Mitigate the Acid Rock Drainage Problem: Cap Ruby Dump



- Cap reduces amount of oxygen entering dump
- Cap reduces amount of water entering dump
- Cutting the amount of air and water entering the dump reduces amount of acid mine drainage needing treatment - that cuts costs to protect Strawberry and Bear Butte Creeks



## RUBY DUMP CAPPING SYSTEM: Slope





Ruby Pond

Ruby Waste Rock Dump  
Earthwork Lower Portion of Ruby  
Depository May 2001





Installation of Underground Acid Water Storage at the toe of Ruby Dump



Initial Liner Installation below  
Bench 1 - August 2002





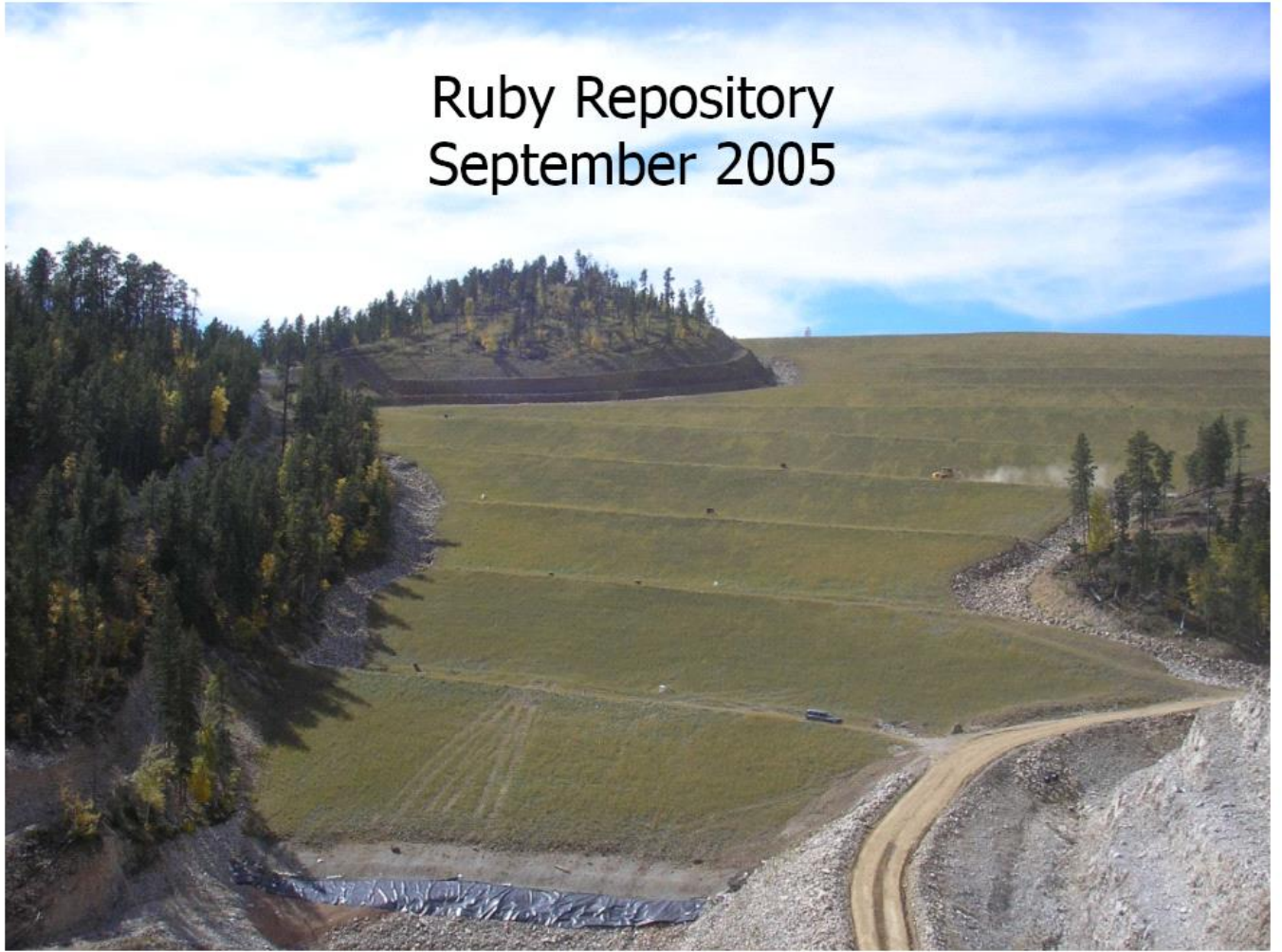
Ruby Depository  
Capping Progress  
October 2002

Drain  
Rock

80 mil  
LLDPE

Geotextile

# Ruby Repository September 2005





# Gilt Edge Superfund Site

## Next Cleanup Phases – EPA Uses Operable Units



# Gilt Edge Superfund Site

## EPA's Next Cleanup Phases:

- Remove spent ore from the Heap Leach Pad and place in open pits (OU1)
- Remove acid generating highwalls and fills across the site and place in open pits (OU1)
- Cap and revegetate open pits (OU1)
- Remove additional old buildings
- Upgrade Water Treatment Plant through automation (OU2)
- Move Water Treatment Plant after OU1 Completion



# Gilt Edge Superfund Site

## Surface Features of EPA Final Site Remedy



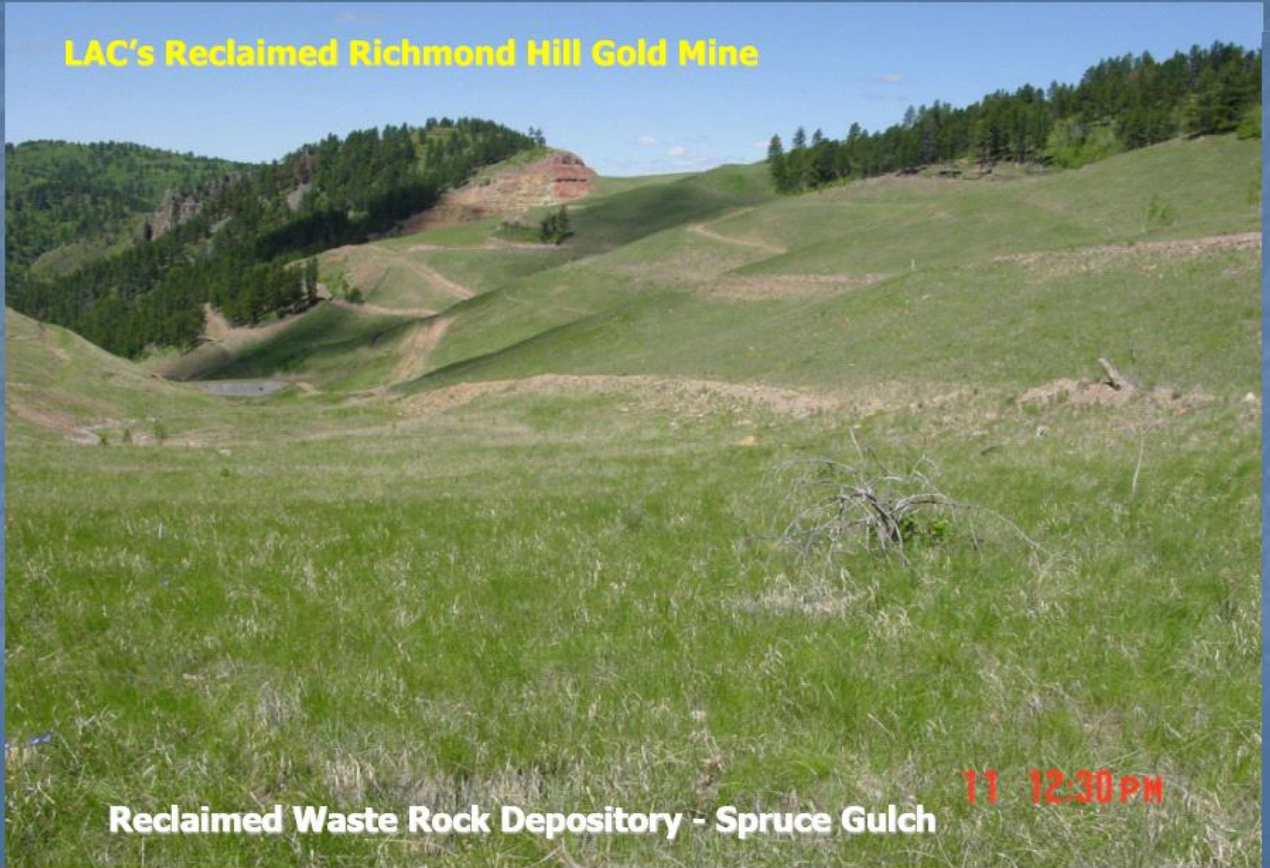
**CDM  
Smith**

GILT EDGE SUPERFUND SITE  
LAWRENCE COUNTY, SOUTH DAKOTA

2014 Explanation of Significant Differences - Alternative 5  
Conceptual Surface Configuration

# An Example of the Finished Project

**LAC's Reclaimed Richmond Hill Gold Mine**



**Reclaimed Waste Rock Depository - Spruce Gulch**

**11 12:30 PM**